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Goalovsvägen 5
S-433 338 Partille(SV)
Inventor: Nordin, Stefan
Knektegårdsgatan 45c
S-441 37 Alingsas(SV)
Inventor: Lindstrom, Martin
Brunstorpsvägen 53
S-443 95 Stenkullen(SV)

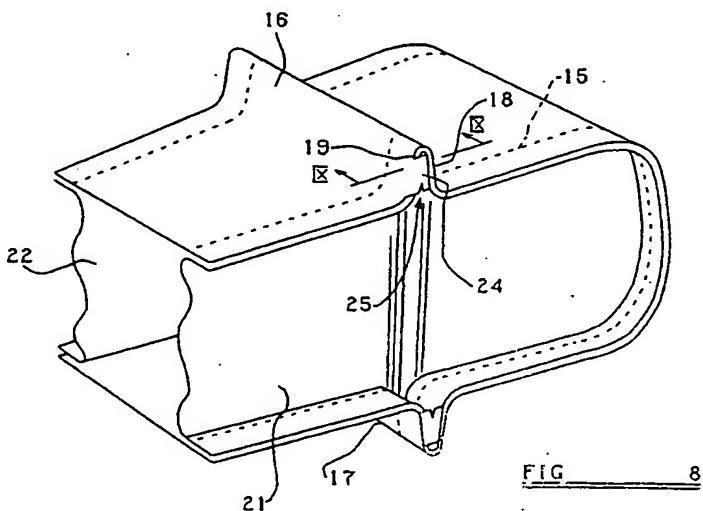
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DE ES FR GB(71) Applicant: GENERAL ENGINEERING
(NETHERLANDS) B.V.
P.O.Box 85007
NL-3508 AA Utrecht(NL)(24) Representative: Frankland, Nigel Howard et al
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
W-8000 München 40 (DE)

(72) Inventor: Skötte, Lars-Gunnar

(54) Improvements in or relating to an air-bag arrangement.

(57) An inflatable bag adapted to protect a driver or passenger in a motor vehicle is formed from one or more elements of fabric (12,13,21,22,23), portions of the fabric being secured together by securing seams (15). There are areas (18,19) of fabric adjacent the securing seams (15) which, if apertured or damaged, do not affect the integrity of the bag. The bag is provided with one or more tearable means (20,24,27)

present in the areas (18,19) of fabric, the tearable means (20,24,27) being designed to break when the bag is exposed to an internal pressure in excess of a predetermined pressure, the tearable means (20,24,27) controlling the way in which the bag is inflated. The interior volume of the bag is greater when the tearable means (20,24,27) have broken.



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THE PRESENT INVENTION relates to an air-bag arrangement and more particularly relates to an air-bag arrangement adapted to protect a driver or passenger in a motor vehicle such as a motor car.

It has been proposed to provide an air-bag in a motor car positioned in front of the driver or in front of a passenger of the motor car, the bag being adapted to inflate in the event that an accident arises. The bag thus provides a "cushion" for the driver or passenger.

The design of air-bags is now very sophisticated, and the bag is adapted to be inflated when the driver or passenger is thrown forwardly within the motor vehicle.

Reference may be made to EP-A-0,344,422 which discloses a bag in which parts of the bag are folded together to form a "tuck" by stitching, the stitching forming a "tear seam". The main purpose of this is to control the way that the bag is inflated. Thus the "tear seam" effectively controls the speed of inflation or the direction in which the bag expands during inflation, so that the bag, when it is inflated, does not hit the driver or passenger with a significant force. The "tear seam" is designed to tear or rip, enabling the "tuck" to open out effectively increasing the interior volume of the bag.

One disadvantage of the system of EP-A-0,344,422 is that the "tear seam" comprises stitching which passes through part of the bag which forms the boundary between the interior of the bag and the exterior of the bag. When the "tear seam" tears or rips, it is to be understood that either the thread forming the stitching can break or the fabric in the region of the seam can tear. It is possible that the fabric will tear along the line of the stitching, since the fabric will have been pierced by the needle when the stitches have been put in place, and the fabric may thus have been punctured or weakened in the line of the stitching. However, it is also possible that the fabric adjacent the actual stitching may tear or rip. In any event, it is quite possible that the fabric of the bag may become damaged. If the fabric of the bag is damaged and is apertured, the bag may deflate in an undesirable manner, and the bag will then not provide the desired cushioning effect.

The present invention seeks to provide an improved air-bag arrangement.

According to the invention, there is provided an inflatable bag adapted to protect a driver or passenger in a motor vehicle, the bag being formed from one or more elements of fabric, portions of the fabric being secured together by securing seams, there being areas of fabric adjacent to the securing seams which, if apertured or damaged, do not affect the integrity of the bag; the bag being provided with one or more tearable means present

in said areas of fabric designed to break when the bag is exposed to an internal pressure in excess of a predetermined pressure, the tearable means controlling the way the bag is inflated, the interior volume of the bag being greater when the tearable means have broken.

It is to be understood that the tearable means may comprise a stitched seam where either the thread forming the seam or the fabric through which the thread passes is adapted to tear, or may comprise a specific portion of fabric provided in the region of a stitched seam which is intended to tear when an appropriate force is applied to the fabric.

Conveniently, the said areas of fabric are under tension when the bag is inflated and define one or more tucks in side walls of the bag.

In one embodiment, the or each tearable means comprises a stitched seam provided adjacent an edge of elements of fabric secured together by the securing seams, there being edge portions of the fabric extending between the securing seams and the edge of the fabric, the "tear seam" being located in said edge portions.

In an alternative embodiment of the invention the or each tearable means is defined by a piece of fabric that extends across and retains a tuck formed in the bag. The piece of fabric may be integral with the fabric of the bag or the piece of fabric may be separate from the fabric of the bag. Preferably the piece of fabric has a weakened portion to facilitate tearing of the fabric, and the weakened part may be constituted by one or more notches formed in the edges of the piece of fabric.

Advantageously, at least one side of the bag is folded to form a tuck so that regions of edge portions of the fabric forming that side of the bag, that is to say portions of the fabric between the edges of the fabric and securing seams provided adjacent the edges of the side of the bag securing that side of the bag to other sides of the bag, are folded to lie adjacent each other, said regions being secured together by said tear seams.

In one embodiment, the said portions of the fabric which do not determine the integrity of the bag are located on the exterior of the bag. Alternatively, the portions of the bag which do not affect the integrity of the bag are located on the interior of the bag.

In one embodiment, the bag is made of a single sheet of fabric of generally cruciform shape.

Alternatively, the bag is made of three sheets of fabric, two sheets forming opposed side walls, and a further sheet forming a top wall, an end and a bottom wall of the bag, in one orientation.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to

the accompanying drawings, in which:

FIGURE 1 is a view of a conventional seam as provided in an air-bag.

FIGURE 2 is a view of an alternative form of seam,

FIGURE 3 is a plan view of a "blank" which can be used for forming a bag,

FIGURE 4 is a view of a bag being made from the blank of Figure 3,

FIGURE 5 is a view of the bag of Figure 4 when completed,

FIGURE 6 is a perspective view of another form of bag,

FIGURE 7 is a view of the bag of Figure 6 when turned inside out,

FIGURE 8 is a view, corresponding to Figure 5, illustrating a modified embodiment of the invention,

FIGURE 9 is a cross-sectional view of Figure 8 taken on the line IX-IX,

FIGURE 10 is a plan view of part of the fabric forming the bag of Figures 8 and 9, and

FIGURE 11 is a view of part of a further modified bag in accordance with the invention, with parts thereof cut-away for the sake of clarity of illustration.

Referring initially to Figure 1 of the drawings, a conventional "interlocked" seam for an air-bag or the like is illustrated. A first sheet of fabric 1 has a terminal edge thereof folded back on itself to form a U-shaped channel 2. A second sheet of fabric 3, to be connected to the first sheet, has a terminal edge thereof folded back to form a U-shaped channel 4.

The folded back edges are then inter-nested so that the two channels 2 and 4 are inter-engaged and then stitching 5 is placed in position extending through four thicknesses of the fabric. Thus, the stitching 5 extends through the parts of the fabric sheet 1 that form both side walls of the channel 2 and through parts of the fabric sheet 3 that form both side walls of the channel 4.

It is to be noted that a seam of this type does not present any exposed free edges of the cloth or fabric.

Figure 2 illustrates an alternate form of seam where two sheets of fabric 6,7 are located with edge portions 8,9 adjacent each other, and a line of stitching 10 is located in position joining the edge portions 8 and 9 together. The stitching is located at a distance from the terminal edge of the edge portions 8 and 9, so the edge portions between the stitching and the edge of the fabric are still clearly identifiable.

It is to be appreciated that if an air-bag is made utilising seams of the type illustrated in Figure 2, the edge portions 8 and 9 do not themselves contribute directly to the integrity of the bag, since

the part of the bag that effectively separates the interior of the bag from the exterior of the bag is effectively defined by the fabric sheets 6 and 7. Consequently, if any tearing or ripping occurs to the edge portions 8 or 9, this will not, of itself, cause deflation of an air-bag made from fabric sheets 6 and 7 as illustrated in Figure 2.

Referring now to Figure 3, a "blank" 11 of fabric is illustrated from which an air-bag may be fabricated. The blank is of generally cruciform shape having a substantially square central region 12 with four orthogonally extending arms 13. Each arm tapers slightly towards its free end.

The "blank" of Figure 3 may be folded to form a bag having the configuration of Figure 4 by folding the four arms 13 to extend parallel with each other in a direction which is perpendicular to the plane of the square central portion 12. The free edges of the arms will then abut each other and stitching may be provided, in the positions indicated by the dotted lines 14 of Figure 3, to constitute seams 15 as shown in Figure 4. The bag is thus formed of a unitary sheet of fabric but edges of the fabric are joined together by securing seams 15. The seams 15 are of general type illustrated in Figure 2, the edge portions of the fabric between the stitching and the edge of the fabric not contributing to the integrity of the bag.

Referring now to Figure 5 of the accompanying drawings, it can be seen that the bag of Figure 4 has been compressed axially, thus forming a tuck 16,17 in the upper and lower walls of the bag. The side walls of the bag will be deformed in a corresponding manner, but will most probably be deformed slightly inwardly of the bag.

It can be seen that the tuck 16 brings together, at either end, regions 18,19 of the projecting edge portions of the fabric of the bag which project beyond the securing seams 15. These abutting regions 18 and 19 are joined together by a zig-zag "tear seam" 20. It can be seen, from Figure 5, that four "tear seams" of this type will be provided in the bag. The "tear seams" maintain the "tucks" and limit the internal volume of the bag.

When the air-bag is inflated and thus has the condition illustrated in Figure 5, the "tear seams" will initially be placed under slight tension. As the pressure in the bag continues to rise the "tear seams" will rip or tear, thus releasing the tucks 16,17 and effectively increasing the interior volume of the bag. The "tear seams" are so located that inflation of the bag is controlled so that the bag does not hit the passenger or driver to be protected by the bag.

The "tear seams" will rip or tear, either by the thread forming the stitching breaking, or by the fabric tearing in the region of the stitching or near the stitching. It can be seen that even if the ripping

of the "tear seams" causes apertures to form within the material of the bag, these apertures will only be in that part of the material of the bag between the securing seam 15 and the edge of the fabric, in other words in a position corresponding to the edge portions 8 and 9 of Figure 2, and this will not influence the integrity of the bag.

Figure 6 illustrates an alternate form of bag, similar to that shown in Figure 5, which comprises two side sheets 21,22 which each correspond with one of the arms 13 of the blank of Figure 3, and a single top, end and bottom sheet 23 which corresponds to the two other arms and the central square region of the blank of Figure 3.

It can be seen that the top sheet is stitched to each side sheet along the top of the bag, across the end of the bag and along the bottom of the bag, in the orientation illustrated in Figure 6.

The remaining features of the bag are as described with reference to the bag of Figure 5.

The bag of Figure 6 may be inverted (or turned inside-out) so that the tucks 16,17 are on the interior of the bag, as shown in Figure 7. This provides the bag with a smoother exterior and minimises the risk of injury to a person who impinges the bag.

It has been found that various types of stitching may be used to form the "tear seams" 20 as described above. Whilst reference has been made to "zig-zag", "tear seams" various forms of stitching may be used comprising one or more straight seams extending parallel with the edge of the fabric, one or more straight seams extending parallel but perpendicularly to the edge of the fabric, or a "castellated" seam. It has been found that these stitched seams do not operate in a totally consistent manner in that the maximum load necessary to cause a stitched seam of this type to tear as compared with the average load, may be significantly greater than the average load. Typically, the maximum load is of the order of two times the average load.

It has been found that more consistent results can be obtained when the tearable means is formed of a piece of fabric that extends across and retains a tuck formed in the bag.

Referring now to Figure 8, which illustrates a modified embodiment of the bag illustrated in Figure 6 (the same reference numerals apply to the same parts), the bag is provided with two opposed tucks 16,17 of the type described above. Referring specifically to tuck 16, the regions 18 and 19 of the projecting edge portions of the fabric of the bag which extend beyond the securing seams 15 in the region of the tuck are joined together by a piece of fabric 24 which is formed integrally with the region 19, and which has a free end portion which is stitched or otherwise secured to the region 18. The

piece of fabric 24 is provided with a weakened central region defined by a notch 25 formed in one side of the piece of fabric. The arrangement is such that when the bag is inflated and subjected to an internal pressure in excess of a predetermined limit, the piece of fabric 24 will tear transversely, the tear commencing at the notch 25. The tear will follow the warp or the weft of the fabric. It has been found that providing a tearable means of this type gives more consistent results in that, in a batch of bags, the maximum force necessary to cause the tearable means to be actuated is very close to the average force for the batch. It can be seen that the tuck 17 is provided with a similar tearable means. Figure 9 provides a sectional view of the arrangement, illustrating how the additional piece of fabric 24 is stitched to the region 18 by a double seam 26. Figure 10 illustrates the edge of the piece of fabric used to form the upper part of the bag illustrated in Figure 8, showing the additional piece of fabric 24 with the notch 25.

It is to be appreciated that whilst, in the embodiment described with reference to Figures 8 to 10, the piece of fabric 24 forming the tearable means is formed integrally with the fabric forming the rest of the bag, the fabric forming the tearable means could comprise a separate element of fabric 27 as illustrated in Figure 11, the extra piece of fabric again having a notch 25 and being secured to the abutting regions 18 and 19 by appropriate seams, one of which, 28, is illustrated schematically.

Whilst the piece of fabric that forms the tearable means has been shown as having one notch formed in one side, the piece of fabric could have two opposed notches formed in the opposed side edges, or could have a central aperture, preferably of "diamond" shape.

A bag having a tearable means as illustrated in Figures 8 to 10 or as illustrated in Figure 11 could again be turned inside-out, so as to resemble the bag shown in Figure 7.

The features disclosed in the foregoing description, in the following Claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. An inflatable bag adapted to protect a driver or passenger in a motor vehicle, the bag being formed from one or more elements of fabric (12,13,21,22,23), portions of the fabric being secured together by securing seams (15), there being areas (18,19) of fabric adjacent to the securing seams (15) which, if apertured or damaged, do not affect the integrity of the bag,

characterised in that the bag is provided with one or more tearable means (20,24,27) present in said areas (18,19) of fabric designed to break when the bag is exposed to an internal pressure in excess of a predetermined pressure, the tearable means (20,24,27) controlling the way the bag is inflated, the interior volume of the bag being greater when the tearable means (20,24,27) have broken.

2. A bag according to Claim 1 wherein the said areas (18,19) of fabric are under tension when the bag is inflated and define one or more tucks (16,17) in side walls of the bag.

3. A bag according to Claim 1 or 2 wherein the or each of said tearable means comprises a stitched seam (20) provided adjacent an edge of elements of fabric secured together by the securing seams (15), there being edge portions of the fabric extending between the securing seams (15) and the edge of the fabric, the seam being located in said edge portions (18,19).

4. A bag according to Claim 1 or 2 wherein the or each tearable means is defined by a piece of fabric (24,27) that extends across and retains a tuck (16,17) formed in the bag.

5. A bag according to Claim 4 wherein the piece of fabric (24) is integral with the fabric of the bag.

6. A bag according to Claim 4 wherein the piece of fabric (27) is separate from the fabric of the bag.

7. A bag according to any one of Claims 4 to 6 wherein the piece of fabric (24,27) has a weakened portion to facilitate tearing of the fabric.

8. A bag according to Claim 7 wherein the piece of fabric (24,27) has one or more notches (25) formed in the edges thereof to constitute said weakened part.

9. A bag according to any one of the preceding Claims wherein at least one side of the bag is folded to form a tuck (16,17) so that regions (18,19) of edge portions of the fabric forming that side of the bag, that is to say portions of the fabric between the edges of the fabric and securing seams (15) provided adjacent the edges of the side of the bag securing that side of the bag to other sides of the bag, are folded to lie adjacent each other, said regions (18,19) being secured together by said tearable means

(20,24,27).

10. A bag according to any one of Claims 1 to 9 wherein the areas of the bag which do not affect the integrity of the bag are located on the interior of the bag.

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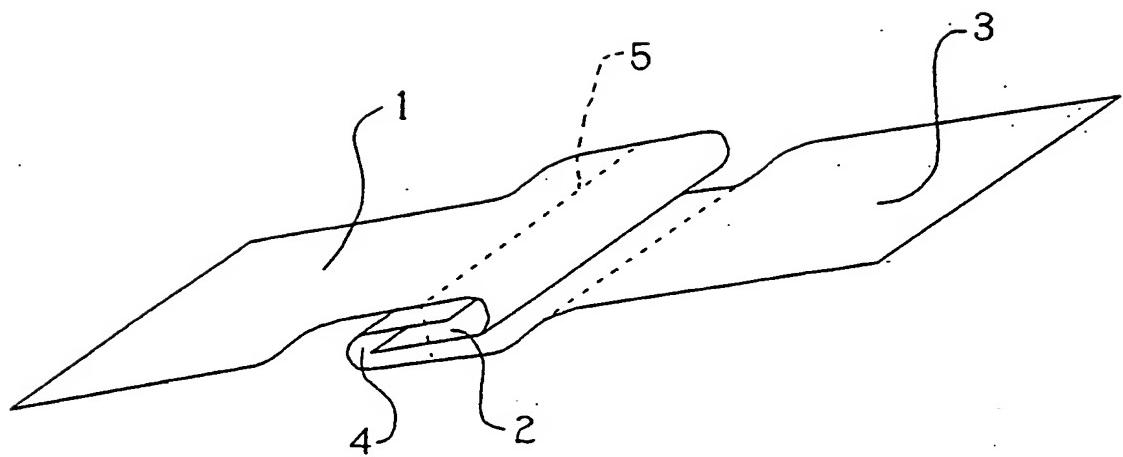


FIG 1

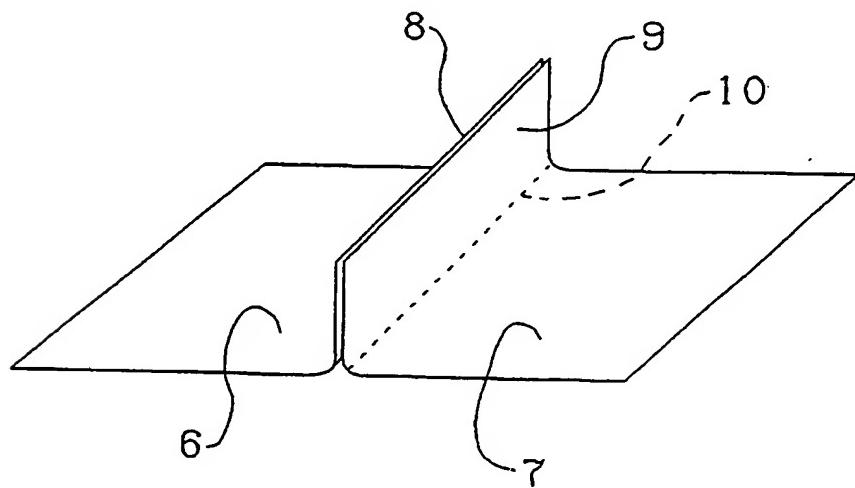


FIG 2

FIG 3

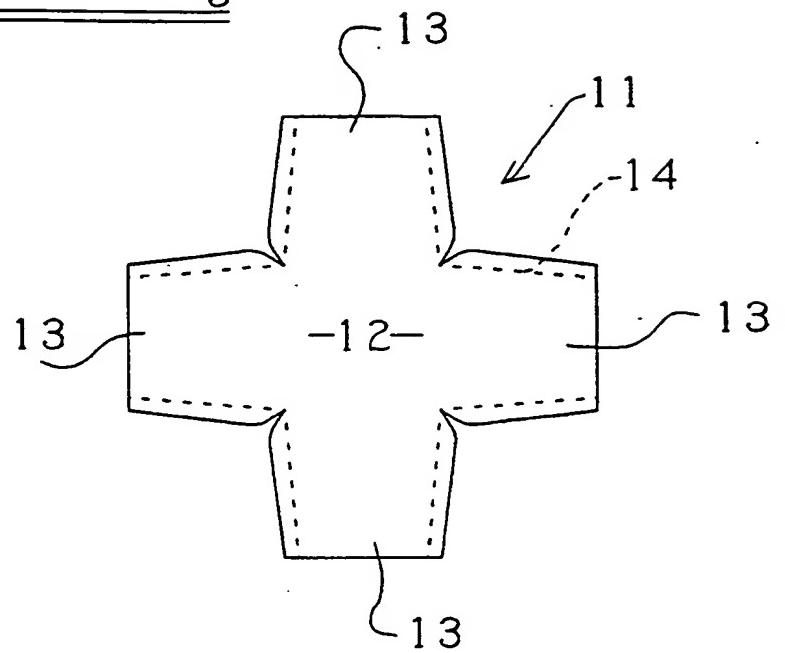
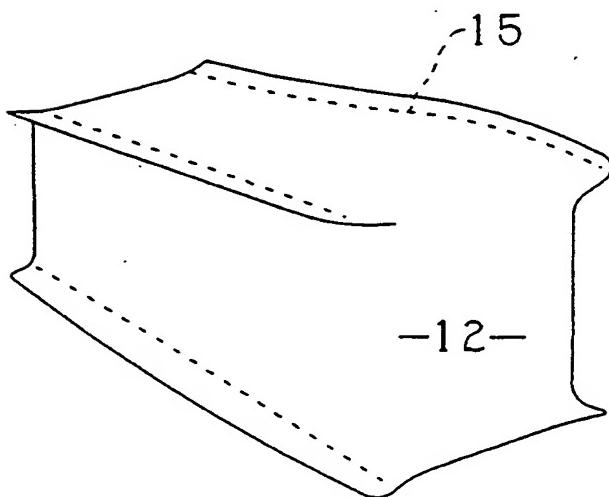
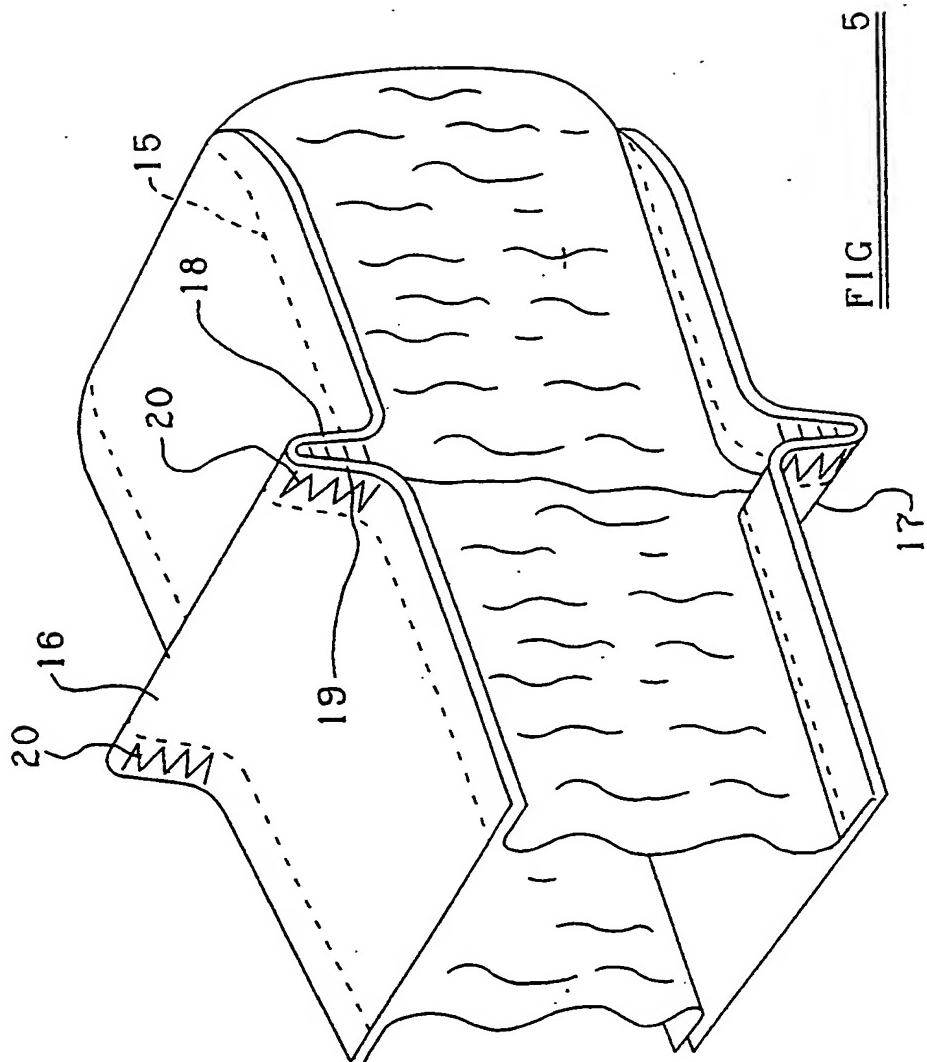
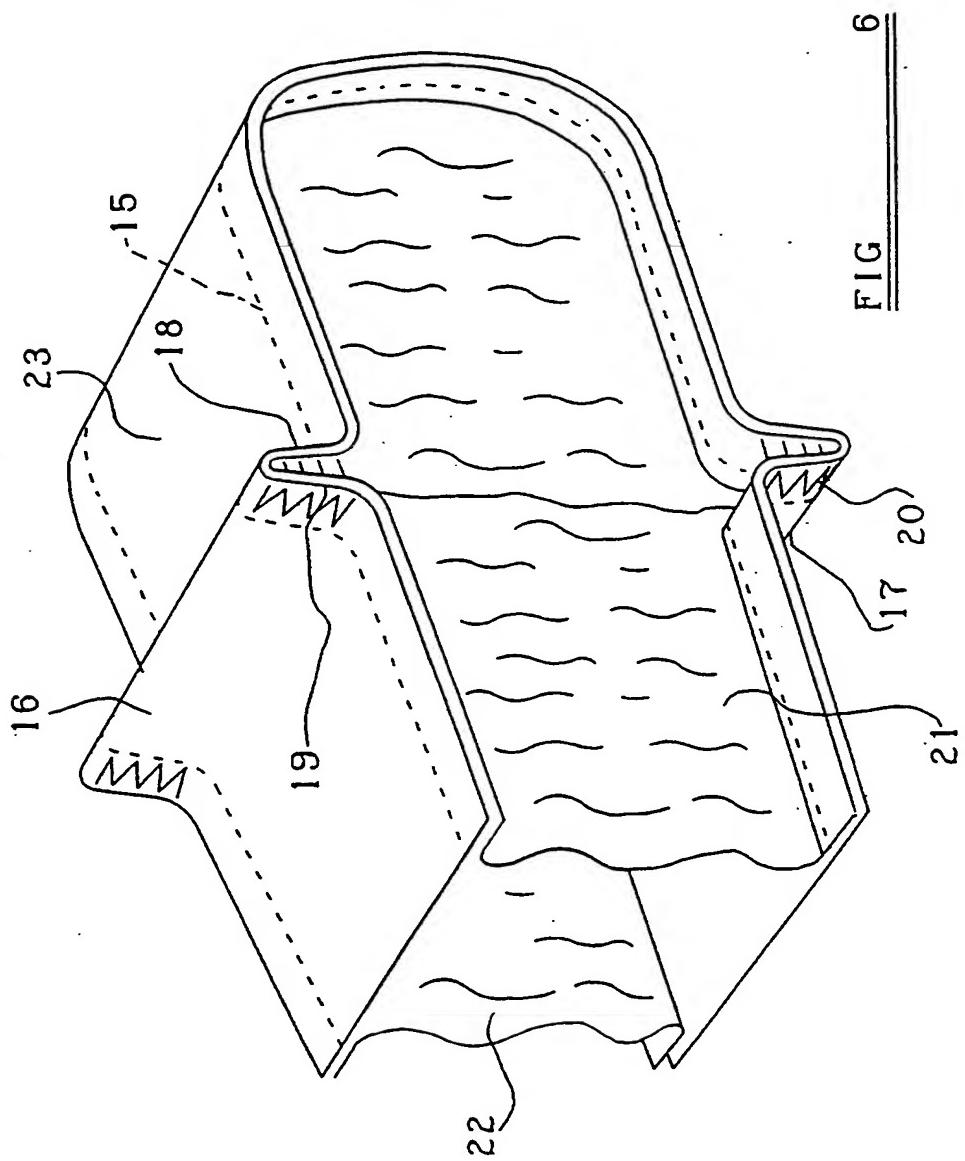


FIG 4







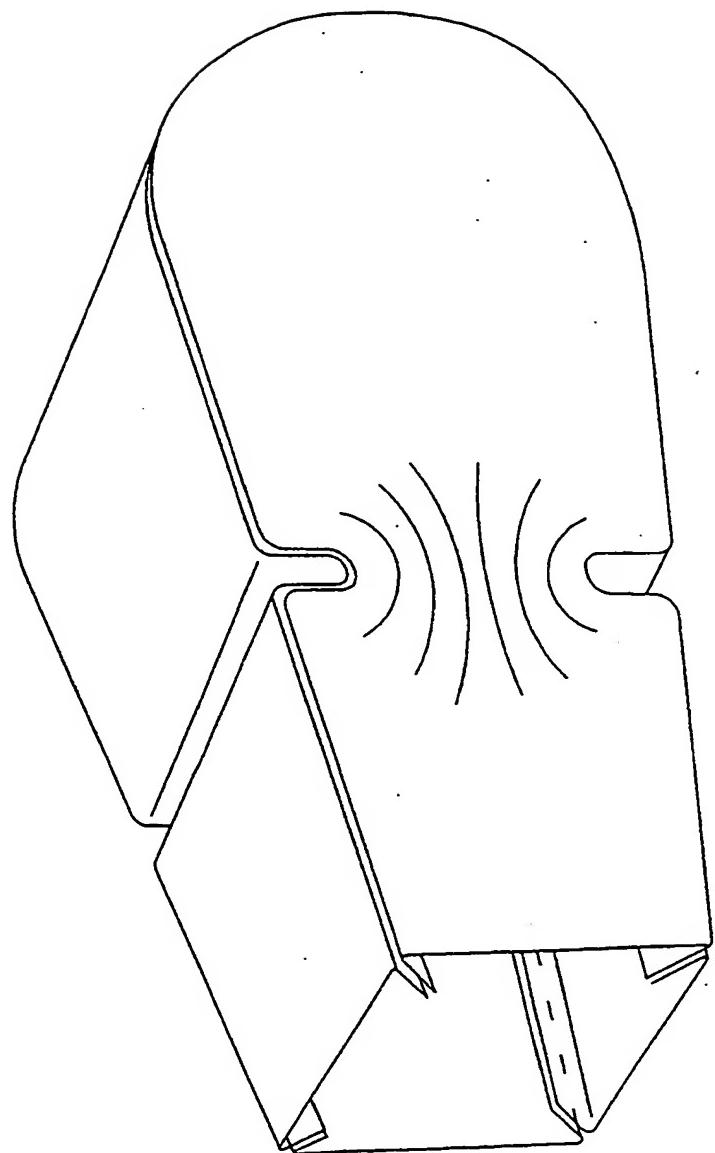


FIG
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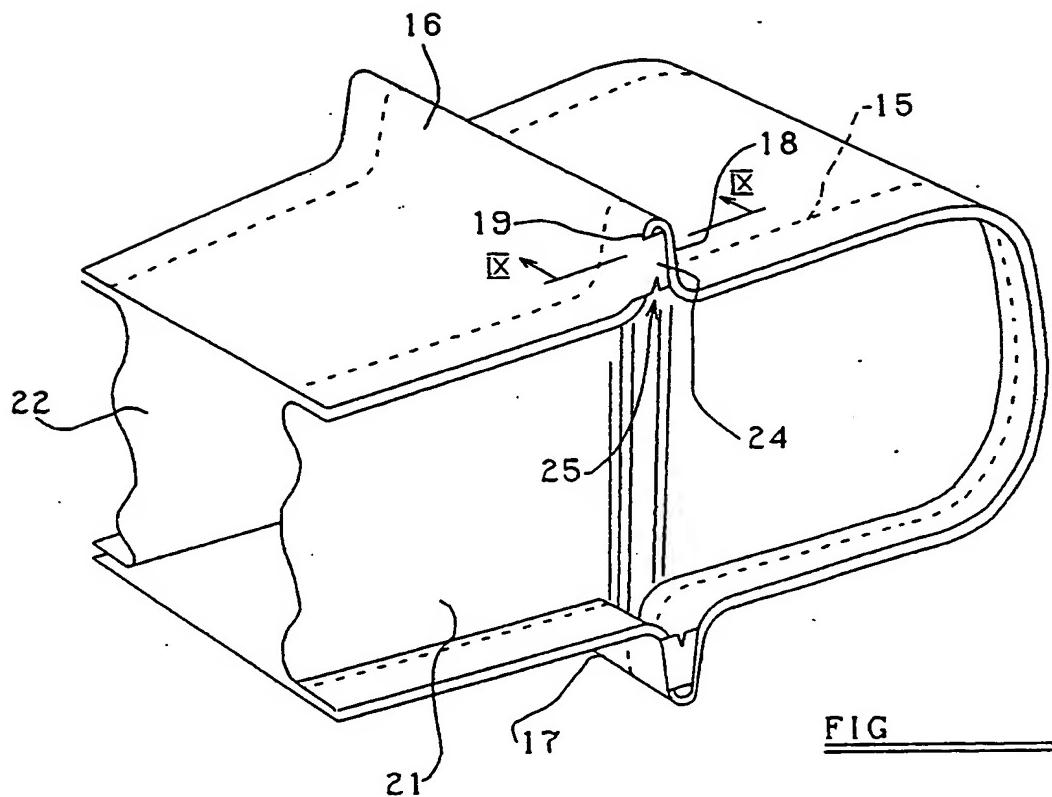


FIG 8

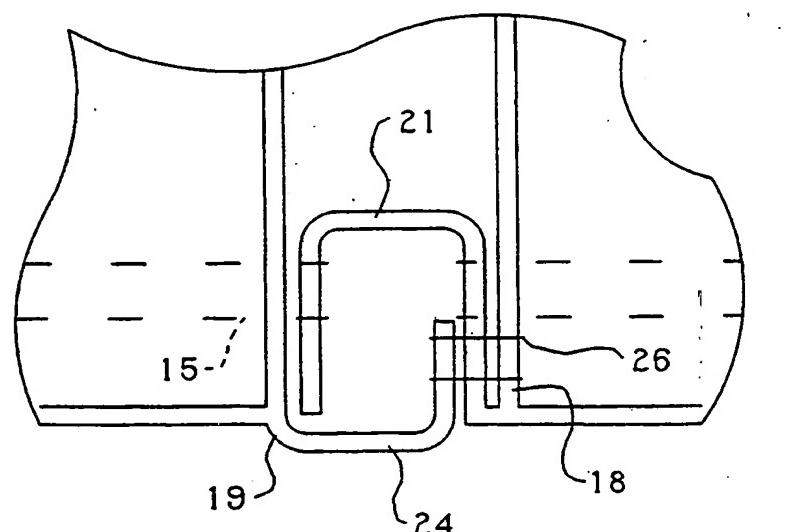


FIG 9

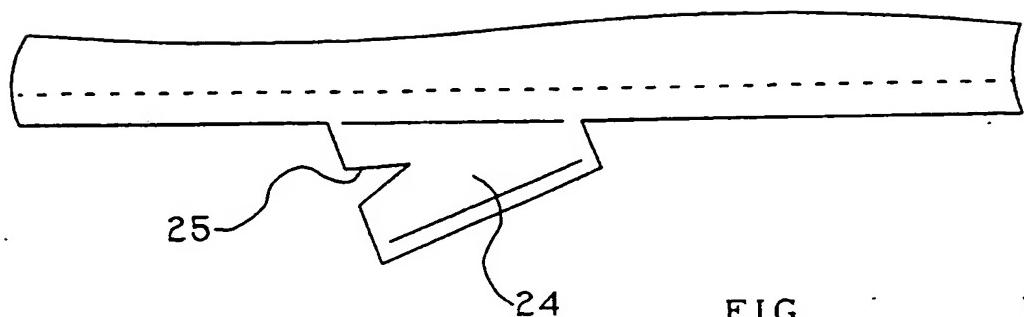


FIG 10

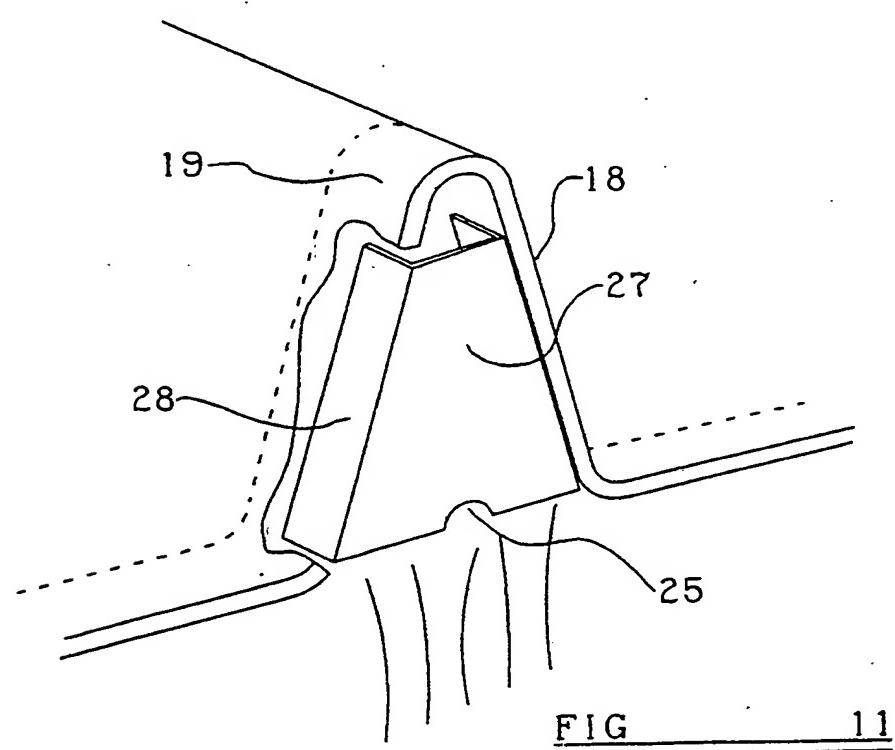


FIG 11



European Patent
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EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 92309219.1
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
D, A	<u>EP - A - 0 344 422</u> (DAIMLER-BENZ) * Fig. 1,3 *---	1	B 60 R 21/22
A	<u>US - A - 5 022 675</u> (ZELENAK) * Fig. 1,5,7 *---	1	
A	<u>US - A - 4 944 529</u> (BACKHAUS) * Fig. 2,6,7,9,10 *---	1	
A	<u>US - A - 4 003 588</u> (OKA) * Fig. 1a,1b,2b *---	1	
A	<u>US - A - 3 810 654</u> (DEBANO) * Fig. 3-10 *----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. CL.5)
			B 60 R
Place of search VIENNA		Date of completion of the search 14-12-1992	Examiner PANGRATZ
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : una-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			